



# All About Kea – a framework to focus kea conservation initiatives

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Authors: Orr-Walker, T <sup>\*1</sup>, Kemp, J<sup>2</sup>, Adams, NJ<sup>1,3</sup>, Roberts, LG<sup>1,3</sup>.

*\*Corresponding author: [info@keaconservation.co.nz](mailto:info@keaconservation.co.nz)*

*1. Kea Conservation Trust, PO Box 2619, Wakatipu, Queenstown 9349.*

*2. Department of Conservation, Private Bag 5, Nelson, New Zealand*

*3. Department of Natural Sciences, Unitec Institute of Technology, Private Bag 92025, Auckland, New Zealand*

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## 1 Vision

A healthy and secure future for kea.

## 2 Mission

To secure a thriving, wild kea population throughout their South Island range and a well-managed captive population, for all to experience.

## 3 Purpose of this document

This document was written to provide context and visibility for kea conservation projects undertaken by various agencies, community groups and individuals. We also hope it will stimulate new ideas and projects from people not yet involved in kea conservation.

*All About Kea – a framework to focus kea conservation initiatives*, will be reviewed every five years (next review date September 2020).

## 4 Background

New Zealand's (NZ) rate of endemic species extinction as a consequence of human settlement is one of the highest in the world (Hitchmough et al, 2007). The New Zealand Biodiversity Strategy (2000), states its intention to "halt the decline of our indigenous biodiversity". However, since the signing of this strategy, threatened species continue to decline. The main reasons for this loss include human settlement and land modification, climate change, and the introduction of predators and competitors (MfE 2007). The Department of Conservation (DOC), which administers the Biodiversity Strategy, states a key focus as "conserving nationally threatened species to ensure their persistence" (DOC 2010). To help support this intention, species recovery plans are developed that outline the process/es of population recovery. To date, 30 recovery plans have been developed for 34 threatened NZ bird species, leaving 43 (including kea) with no formal recovery plan.

Kea are renowned as one of the world's most intelligent birds, are part of a select group of animal tool-users, provide essential ecosystem services, and, as the only mountain parrot in the world, bring colour and character to our southern landscapes. However, for all of its unique qualities, the future of kea remains uncertain. NZ's unique, endemic parrot, the Kea (*Nestor notabilis*), is disappearing from the mountains of Te Waipounamu, due to a cocktail of threats, past and present.

An estimated 150,000 kea were culled between the late 1860s and early 1970s during a government-sponsored control scheme involving the payment of a bounty. Although fully protected since 1986, kea continue to face a range of anthropogenic threats, including predation by introduced mammals, accidental trapping and poisoning, ongoing persecution, and injury and death through interaction with human property.

Kea are now listed as Nationally Endangered under the New Zealand Threat Classification System (Robertson et al, 2013) and Vulnerable on the IUCN Red List reflecting a continuing population decline (Birdlife, 2012). The total population size is difficult to estimate, but may be less than 5,000 individual birds.

The NZ Bird Atlas (Robertson 2007) shows that the kea population is sparsely spread across its range of approximately 3.5 million hectares from Waitutu in the far south, to Kahurangi in the northwest

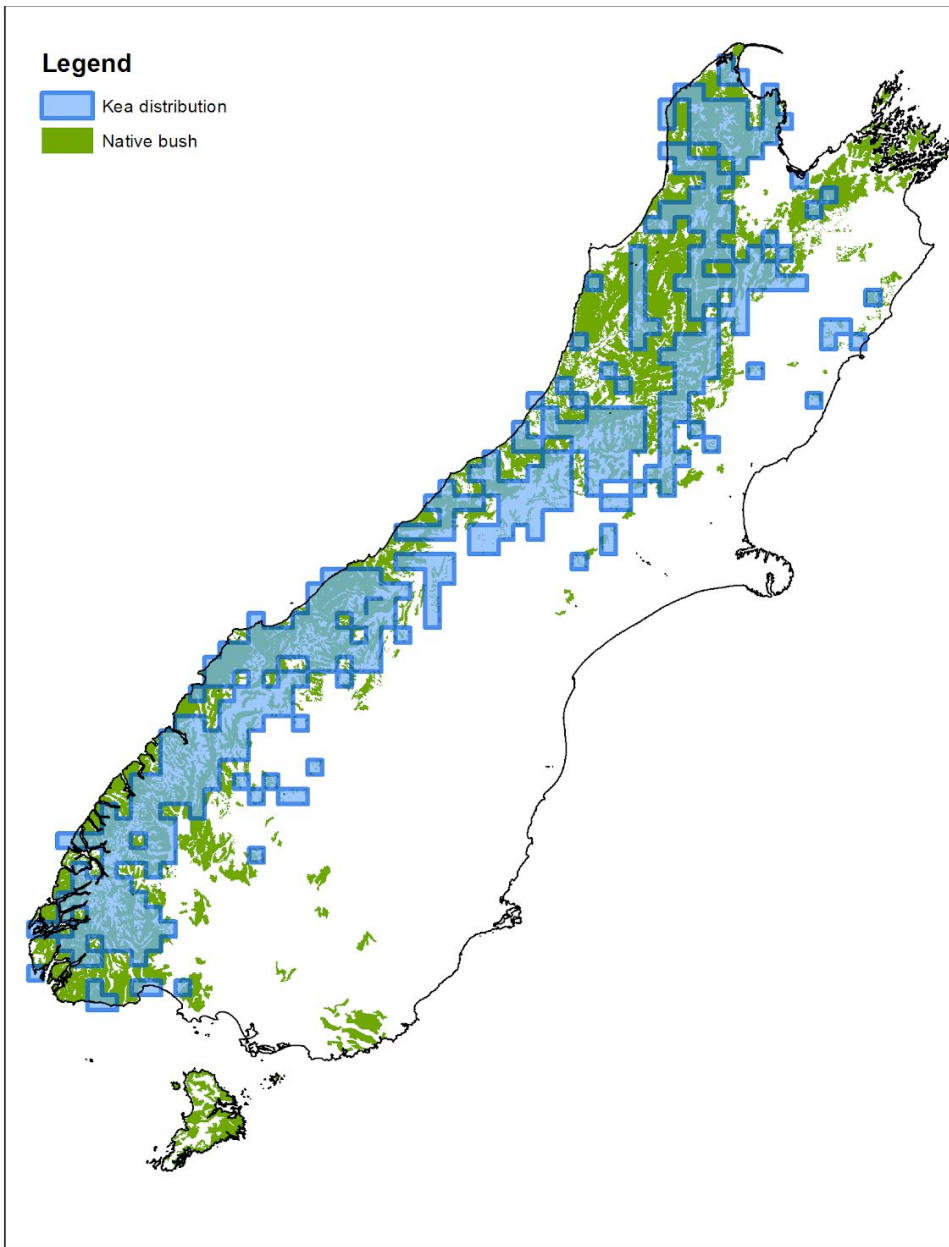
(Figure1). Pockets of high population densities persist in some areas, such as around Arthur's Pass and South Westland (Kemp and van Klink pers comm). However, a rapid decline since 1998 in the unmanaged Nelson Lakes National Park is cause for serious concern (Adams et al, 2011), as are numerous anecdotal reports of decreases from other unmanaged areas.

Kea are a highly distinctive species (de Kloet, 2005). Together with kakapo and kaka, they form the longest and deepest branch of the parrot family tree having diverged very early from other parrot lineages. As such, the kea is an international treasure. They also fulfil a vitally important role within our mountain ecosystem as alpine seed distributors (Young et al, 2012) and, anecdotally, are an important draw card for tourists to New Zealand. For many people, kea epitomise what it means to be a New Zealander; fearless, adventurous, adaptive, and fun-loving with the kiwi 'number 8 wire mentality'. They are considered 'guardians of the mountains' by Waitaha Maori and taonga (treasure) by Ngāi Tahu. Our mountains would certainly be the poorer without the presence of New Zealand's charismatic "clown of the mountains" (Diamond and Bond, 1999) and less colourful without New Zealander's fabled 'feathered wolf'.

The knowledge that kea may decline to extinction within our lifetimes triggered the development of this strategic plan. This document has built on earlier conservation and advocacy initiatives driven in the main by DOC. These include the Kea-Kaka Population Viability Analysis (Grant et al 1993); the purpose of which was to facilitate the development of conservation strategies to assure the continued survival and adaptive evolution of kea and kaka; the Wild Kea Management Statement (Grant, 1993) which identified a number of areas to support kea conservation including i) obtaining baseline ecological information, ii) promoting and enhancing the public perception of kea and iii) appropriately managing (anthropogenic) problems involving kea; the Kea Advocacy Strategy (Peat, 1995), which aimed to reduce the extent of human-kea conflict through a range of advocacy initiatives and; the Kea Captive Management Plan and Husbandry Manual (Pullar, 1996), which sought to direct management of a self-sustaining population of kea in captivity to support conservation of kea in the wild.

A review of these and other kea research publications (in-situ and ex-situ), in the early 2000s led to the establishment of the Kea Conservation Trust (KCT), a charitable non-governmental organisation (NGO), in 2006. The trust aims to assist in the conservation of wild kea and to increase the husbandry standards and advocacy potential of captive kea within New Zealand. Since its inception, a new Captive Husbandry Manual (2010) has been developed, as well as a number of projects initiated in collaboration with DOC: population estimates, nest monitoring, pest control, community advocacy, conflict resolution and education programmes (funded by both national and international funding and stakeholder organisations).

This document outlines a direction for the conservation and management of kea in New Zealand. The working document generates four focal areas, each of which are described in detail and addressed in separate management documents.



**Figure 1. Map of kea distribution across the South Island (based on Robertson et. al. 2007, Atlas of Bird Distribution in New Zealand).**

## **5 Focal areas critical to achieving the Vision and Mission**

Four main focal areas have been identified to enable kea conservation outcomes:

1. Population size, trends and dynamics are understood.
2. Threats to kea are identified and actively managed .
3. Positive public perception and awareness of kea is increased amongst all stakeholders.
4. The captive population is actively managed to increase welfare, education, advocacy, and research potential.

Each of these areas will be summarised briefly below and addressed in detail in separate management documents.

## **5.1 Focus area 1: Population size, trends, dynamics, and genetic structure are measured and understood.**

In order to achieve our Vision and Mission, factors underpinning the status of the kea population must be better understood. This focus area can be broken into three themes:

1. Abundance (or relative abundance)
2. Population dynamics
3. Genetics

### **5.1.1 Measuring abundance (or relative abundance)**

Methods for measuring abundance and/or relative abundance of kea are not well developed. Several aspects of kea ecology conspire to make this work very difficult using traditional methods such as territory mapping, capture-mark-recapture and distance sampling. In this space the KCT simply undertakes to encourage and facilitate brainstorming and testing of new ideas and new technologies.

### **5.1.2 Understand kea population dynamics**

Understanding of population dynamics in animal populations can be facilitated by population simulation modelling. This is a computer-based method requiring field estimates of vital rates, such as sex ratio, age structure, age at first breeding, annual productivity rates, annual age-specific survival rates, and migration/dispersal rates and distances. Population models use this information to identify which factors have most bearing on the growth of a population over time. This type of modelling helps to target research, monitoring, and management to the most critical factors impacting population growth.

Our approach to understanding kea population dynamics is to develop and maintain a functioning population model for kea. The model will be used to simulate scenarios involving different management regimes and approaches, which can then guide field studies and management actions.

### **5.1.3 Understand the drivers of genetic structure**

The wild kea population displays moderate genetic structure with up to 3 genetic clusters forming a genetic gradient from north to south. This structure results from distance-driven isolation following post-glacial population expansion. This level of population genetic structure is surprising considering that the species' habitat is continuous and kea can travel long distances. (Dussex et al, 2014). Comparison of contemporary, historical and fossil samples show a loss of mitochondrial diversity and population size since the end of the last glaciation (Otiran Glacial), but no loss of overall genetic diversity despite the government-sponsored kea cull. Microsatellite variation indicates a recent bottleneck for only one population (i.e. cluster) and a range-wide decline in effective population size dating back some 300 – 6,000 years ago, a period predating European arrival in NZ. Combined, these results suggest that despite a high level of recent human persecution, kea might have experienced a large population decline in response to Holocene changes in habitat distribution well prior to human settlement of NZ. These results therefore show that it is necessary to understand the respective effects of climate change, and human activities on endangered species dynamics and population structure (Dussex et al, 2015).

In the context of the present conservation plan, management of core populations could be considered to avoid inbreeding or to re-establish viable populations. Conservation efforts should aim to maintain the high genetic diversity of the Aspiring, Nelson Lakes and Fiordland populations (Dusseix et al, 2014) to maintain as much evolutionary potential as possible (Moritz 1994b; Moritz 2002; Conner & Hartl 2004). The identification of three clusters suggests a strategy for translocations is to restrict movements between nearby mountain ranges and only within clusters rather than between them. Additionally, research into kea foraging behaviour (Greer, 2015) suggests dietary differences between lowland versus highland kea with resulting morphological and sexual selection implications. Further studies on the impact of translocation of individuals across genetic clusters and potential disruption of local adaptation should therefore be considered.

Finally, even though no loss of genetic diversity associated with the government cull was detected, the recent population decline exacerbated by introduced predators means that small and isolated populations could be subject to inbreeding depression. Level of inbreeding should therefore be assessed in wild kea populations.

## 5.2 Focus area 2: Threats to kea are identified and actively managed.

Kea populations (in-situ and ex-situ) are currently under-managed. The wild kea population is subject to a complex range of threats impacting on productivity and survivorship and the captive population is under-utilised. Further, many captive kea are recipients of substandard husbandry. Active management of the wild and captive populations will be addressed through development and implementation of a **National Threats Management Plan**, which will direct the following:

1. Threats to the wild kea population and their management are identified, quantified and acted on.
2. Feasibility of an insurance population is investigated.

### 5.2.1 Identify and quantify threats and their management

The range of the kea falls largely within public conservation land. Consequently, habitat fragmentation and loss are not major threats as with many other of our native species. However, eight threats, actual and potential, to the wild kea population have been identified by kea researchers. These may be broadly defined as either environmental and ubiquitous (1-5), or as human and localised (6-8):

- 1) Predation by introduced mammals
- 2) Accidental death through pest control operations
- 3) Lead in kea habitat (e.g. flashings and lead-head nails, tyre weights, lead shot)
- 4) Feeding kea
- 5) Avian diseases
- 6) Climate change (e.g. changes in predator abundance, food availability and habitat quality)
- 7) Human induced injury and death (e.g. motor vehicles, snow groomers, rubbish bins, electricity sub-stations)
- 8) Destruction/removal of nuisance individuals (permitted or illegal)
- 9) Black market trade in wildlife

The relative impact of each, their requirement for active management versus ongoing monitoring, and methods of threat mitigation (minimisation versus removal) are to be investigated.



### 5.2.2 Investigate feasibility of an insurance population

Insurance populations are used to mitigate the risk of species extinction. These populations preserve an important genetic resource through two main methods: captive breeding programmes or development of island populations (mainland (fenced/open) and offshore). Both methods have a number of practical challenges that must be weighed up (extinction risk to the species versus cost of setting up and maintaining an insurance population).

Intensive monitoring of kea over the past 5 years has shown that substantial population declines can occur within a few years. Although intensive monitoring can pick up major changes in population stability, it is not feasible to carry out such monitoring across the species' range. Potentially less than 5,000 kea remain in an area of 3.5 million hectares – much of which is inaccessible and the population within it little studied. As such, the feasibility of an insurance population or populations should be investigated until such time as threats in the wild are mitigated to an acceptable level.

### 5.3 Focus area 3: Public perceptions, awareness of and interactions with kea are proactively and positively directed.

Kea are often attracted to sites of human activity. Historically this has resulted in serious conflict situations with a resulting kea cull extending over 100 years. Today the perception of kea as destructive and a nuisance still persists in some areas and kea conflict situations and persecution continue, albeit to a lesser (reported) degree. In order to reduce conflict situations and increase positive public perception and behaviour towards kea, as well as to increase the scope and level of conservation management, a programme which facilitates local community buy-in to, and involvement in, kea conservation initiatives is imperative. To achieve this aim, a **Community Kea Engagement Plan** will be designed, implemented, and evaluated to:

1. Increase positive view and understanding of kea
2. Engage with mana whenua
3. Engage with communities to transform conflict
4. Increase education and research opportunities
5. Facilitate formation of community led kea conservation initiatives

#### 5.3.1 Increase positive view, knowledge and understanding of kea

Increasing positive perception and awareness of kea is the first step in decreasing conflict and increasing interest in and support for conservation initiatives. Reducing conflict also requires a practical response to conflict situations and, as such, provision of a proactive community-focused conflict response and resolution programme South Island wide is required. This aims to identify the nature of conflict experienced by people living within kea habitat, provide 'first response' during conflict situations, help people deal proactively to prevent conflict situations arising in the first instance, and research practical methods of conflict resolution in collaboration and partnership with communities and DOC.

#### 5.3.2 Engage with mana whenua

Kea are a taonga species which have special spiritual and cultural significance to mana whenua. As such, it is important to develop and strengthen relationships between iwi and other conservation stakeholders, to share knowledge and better deliver and support kea conservation outcomes for the future.



### **5.3.3 Engage with communities to transform conflict**

Human – Wildlife conflict (HWC) is a serious and growing global phenomena common to all areas where wildlife and human populations coexist and share limited resources. It “occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife” and, “is as much a conflict between humans and wildlife as it is a conflict between humans about wildlife (Madden, 2004)”. Kea conflict with high country sheep farmers was first documented in the late 1860’s (Marriner, 1908). High sheep losses were attributed to kea and by the 1870’s a government bounty was initiated which resulted in an estimated 150,000 kea killed up until the early 1970’s. Today the perception of kea as destructive and a nuisance still persists. Changes in land use and increasing human activity and access into high country areas results in kea coming into contact with more people and their property. Property damage is reported each year by private landowners (including sheep farmers), tourists, tourist operators and workers and it is recognised that many more conflict events may go unreported. Identifying the nature of conflict experienced by people living within kea habitat, providing support during conflict situations and researching practical methods of conflict resolution will be important to de-escalate conflict situations early on.

### **5.3.3 Increase education opportunities and support external research initiatives**

Effective education, both formal and informal, is key to increasing knowledge, interest in, and positive perceptions of kea. Any education programme must allow engagement of diverse cultures, communities, social dynamics, ages, education levels, and abilities. Key messages and learning outcomes should also be identified and developed to be rolled out quickly and effectively in response to specific issues occurring in order to maximise learning and media impact (eg. Kea killed while car surfing at Otira Viaduct). Formal education channels and relationships should be developed at primary, secondary and tertiary levels to enable external development of education material that can be shared between and supported by kea stakeholders. Advocating for and supporting kea research will significantly speed up the delivery of conservation outcomes for kea. To enable this, a research and projects list should be made available to all appropriate research organisations who express an interest in the objectives of this strategy to provide direction and opportunity for involvement. Additional knowledge and support should also be available through a network of advisors.

### **5.3.4 Facilitate formation of community-led kea conservation initiatives**

The importance of communities buying-in to the success and longevity of local conservation initiatives has been demonstrated repeatedly worldwide (Berkes, 2004). Increasing community collaboration and involvement with kea conservation initiatives will be achieved through a number of key projects, including development of a memorandum of understanding (MOU) directly between communities and kea, development of an active and effective volunteer base, and supporting and encouraging external stakeholder kea conservation initiatives.

## **5.4 Focus area 4: The captive population is actively managed to increase welfare, education, advocacy, and research potential.**

The advocacy, education and research potential of captive kea held by permit holders in NZ, is currently not being fully realised. Although minimum and best practice standards for kea are detailed in a Kea Husbandry Manual (Orr-Walker, 2010), kea are still being held inconsistently. Additionally, the lack of a standardised advocacy plan or a commitment to utilise captive kea in

research to support in-situ populations, means the value of the captive population is currently not maximised.

#### **5.4.1 Ensure best practice welfare and husbandry standards of all kea permit holders**

The Kea Husbandry Manual, developed by the KCT and endorsed by DOC and the Zoo and Aquarium Association (ZAA), aims to increase the welfare of kea in NZ facilities. The standards require permit holders to hold kea in large, complex, enriched environments that provide opportunity to express natural behaviours, thereby improving mental and physical health and encouraging more positive public perceptions and opportunities for education/research.

In 2012, DOC conducted an audit of all NZ kea facilities. As a result, a number of birds have been removed or identified for removal from substandard facilities and/or enclosures, and husbandry techniques required to be upgraded. Further follow-up to ensure compliance with permitted holders is still required.

#### **5.4.2 Develop effective advocacy messaging to support kea in-situ**

76 kea are held in 20 facilities around New Zealand (2015). 17 of these facilities are open to the public and welcome over 1,000,000 people annually through their doors. These facilities have the potential to educate and influence the perceptions and behaviour of visitors about the species in their care and to inform about wider conservation initiatives outside their walls. As stated by DOC, the primary purpose for holding and displaying kea in captivity in New Zealand is to advocate for kea conservation in the wild (Collen, 2011). This includes an undertaking to raise awareness of threats to the species, increase empathy and understanding for kea, educate the public on appropriate behaviour when in kea habitat and to encourage public involvement in conservation initiatives. Recommendations from a review of captive kea management (ibid) state that an advocacy plan that identifies “appropriate advocacy objectives, and the actions and resources needed to achieve them” should be developed and that implementation of this plan should be “part of permit holders’ requirements to hold kea”.

#### **5.4.3 Support education and research to support in-situ conservation initiatives**

Captive kea provide a unique opportunity to increase our understanding of kea (behavioural and physiological responses) and to test new conservation tools (such as new pest control methods, repellents etc) in a safe and controlled situation. A number of permit holders are actively engaged with in-situ kea managers to support research, having this as a requirement of permit renewal, would benefit conservation efforts.

## **6 Standard Operating Procedures**

Ensuring consistent, best practice in all aspects of kea conservation work will result in high quality conservation outcomes for the species. Discussion and development of Standard Operating Procedures (SOPs) will ensure clarity (to those working with kea), consistency (of process, standards and data collection) and minimisation of risks. These will be divided into two main areas i) SOPs for processes and ii) SOPs for those working directly with kea.

Each protocol will be updated as new technology and information becomes available (to be reviewed annually).

## 7 Assessment of outcomes – implementation, monitoring, reporting and review

The aims and projects outlined in this document must be able to adapt and evolve in response to on-going monitoring and assessment of outcomes. Reevaluation and reassessment of individual projects will be conducted annually, while the document itself is to be reviewed every 5 years. This will ensure that projects that are implemented remain responsive to real needs and that strengths, weaknesses, opportunities and threats for each project and the management documents are identified and managed (Bryson & Alston, 2011).

## 8 Acknowledgements

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## 9 Bibliography

Adams, N.J., Kemp, J., Orr-Walker, T., and Roberts, L.G. 2011. Surveying the Southern Alps: Substantial differences in indices of kea (*Nestor notabilis*) abundance across its range may reflect response to pest management. Australasian Ornithological Conference, James Cook University, Cairns.

Berkes, F. 2004. Rethinking Community-Based Conservation. *Conservation Biology*, Pages 621 -630. Vol 18, No.3, June 2004.

BirdLife International 2012. *Nestor notabilis*. The IUCN Red List of Threatened Species. Version 2015.2. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 29 June 2015.

Bryson, J.M and Alston, F.K. 2011. *Creating your strategic plan*. Third edition. A workbook for public and nonprofit organisations. Published by Jossey-Bass, San Francisco, CA.

Collen, R. 2011. Review of captive management of kea (*Nestor notabilis*) - report on initial consultation with stakeholders July 2011. Docdm-790070. Retrieved June 29 2015 from <http://www.doc.govt.nz/Documents/conservation/native-animals/birds/kea-consultation-report.pdf>

de Kloet, R. S. and de Kloet, S. R. 2005. "The evolution of the spindlin gene in birds: Sequence analysis of an intron of the spindlin W and Z gene reveals four major divisions of the Psittaciformes." *Molecular Phylogenetics and Evolution* **36**(3): 706-721.

Diamond, J. and Bond, A. 1999. *Kea Bird of Paradox: The Evolution and Behaviour of a New Zealand Parrot*. University of California Press, Ltd. London, England.

Department of Conservation (DOC). 2010. Statement of Intent 2010-2013. Retrieved on May 14, from [http://www.doc.govt.nz/upload/documents/about-doc/role/policies-and-plans/statement-of-intent/statement-of-intent-\(2010-2013\).pdf](http://www.doc.govt.nz/upload/documents/about-doc/role/policies-and-plans/statement-of-intent/statement-of-intent-(2010-2013).pdf).

- Dusseux, N., D. Wegmann, N.D., and Robertson, B.C. 2014. Postglacial expansion and not human influence best explains the population structure in the endangered kea (*Nestor notabilis*). *Molecular Ecology*. *Mol Ecol*. 23(9):2193-209.
- Dusseux, N., Rawlence, N.J., Robertson, B.C. 2015. Ancient and Contemporary DNA Reveal a Pre-Human Decline but No Population Bottleneck Associated with Recent Human Persecution in the Kea (*Nestor notabilis*). *PLoS One*. 10(2):e0118522.
- Elliott, G and Kemp, J. 1999. Conservation Ecology of Kea. WWF NZ – Final Report.
- Grant, A., O'Donnell, C., Garland, P. 1993. Population viability analysis. Kea (*Nestor notabilis*) and Kaka (*Nestor meridionalis*). New Zealand Department of Conservation and IUCN/SCC Captive Breeding Specialist Group. Christchurch, NZ.
- Grant, A. 1993. Wild Kea Management Statement. Canterbury Conservancy Miscellaneous Report Series No. 4. Department of Conservation, Te Papa Atawhai, Christchurch.
- Greer, A.L. 2015. Intraspecific variation in the foraging ecology and morphology of kea *Nestor notabilis*. A thesis submitted in partial fulfilment of the requirement for the Degree of Doctor of Philosophy in Ecology. University of Canterbury, Christchurch, New Zealand.
- Hitchmough, R. Bull, L. Cromarty, P (compilers). 2007. New Zealand Threat Classification System Lists –2005. Retrieved May 14 2015 from <http://www.doc.govt.nz/templates/MultiPageDocumentTOC.aspx?id=42704>.
- McBride, N. 2011. Endangered Species Management Planning in New Zealand. A thesis in partial fulfilment of the requirements for the degree of Master of Applied Science in Natural Resource Management at Massey University, Palmerston North, New Zealand.
- Ministry for the Environment (MfE) 2007. Environment New Zealand 2007. Retrieved on May 14, 2015 from <http://www.mfe.govt.nz/publications/ser/enz07-dec07/>.
- Parliamentary Council Office (PCO), 1998. Ngāi Tahu Claims Settlement Act 1998. Sections 287 - 296  
Downloaded from <http://www.legislation.govt.nz/act/public/1998/0097/latest/DLM429090.html#DLM430185>
- Parry, M.L, Canziani O.F., Palutikof J.P., van der Linden P.J. and Hanson C.E. (eds) 2007. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Peat, N. 1995. Kea Advocacy Strategy. Towards resolving conflicts between kea and people. Miscellaneous Report Series No.28, Department of Conservation, Dunedin.
- Pullar, T. 1996. Kea (*Nestor notabilis*) Captive Management Plan and Husbandry Manual. Threatened Species Occasional Publication No.9. Department of Conservation Threatened Species Unit, Wellington.
- Robertson, C.J.R, 2007. Atlas of Bird Distribution in New Zealand. The Ornithological Society of New Zealand, Inc. Wellington.
- Robertson HA, Dowding JE, Elliott GP, Hitchmough RA, Miskelly CM, O'Donnell CJF, Powlesland RG, Sagar PM, Scofield RP, Taylor GA. 2013. Conservation status of New Zealand birds, 2012. New Zealand Threat Classification Series 4. Department of Conservation, Wellington. 22p.

Young, L.M, Kelly, D., Nelson, X.J. 2012. Alpine flora may depend on declining frugivorous parrot for seed dispersal. *Biological Conservation* 147 (2012) 133–142.